ICU
MANAGEMENT & PRACTICE

Study Suggests Discarded Kidneys Could be 'Recycled' to Produce Replacement Organs for Transplants

Nearly 20 percent of kidneys that are recovered from deceased donors in the U.S. are refused for transplant due to factors ranging from scarring in small blood vessels of the kidney's filtering units to the organ going too long without blood or oxygen. But, what if instead of being discarded, these organs could be "recycled" to help solve the critical shortage of donor organs?

Researchers at Wake Forest Baptist Medical Center and colleagues, reporting in the journal *Biomaterials*, found that human kidneys discarded for transplant can potentially serve as a natural "scaffolding material" for manufacturing replacement organs in the lab using regenerative medicine techniques.

According to the authors, more than 2,600 donor kidneys are discarded each year in the U.S. "With about 100,000 people in the U.S. awaiting kidney transplants, it is devastating when an organ is donated but cannot be used," said Giuseppe Orlando, M.D., Ph.D., lead author, a Wake Forest Baptist transplant surgeon and regenerative medicine researcher. "These discarded organs may represent an ideal platform for investigations aimed at manufacturing kidneys for transplant."

The research involved pumping a mild detergent through kidneys that were refused for transplant. The goal of the process, called decellularization, is to remove all cells – leaving only the organ structure or "skeleton," known in regenerative medicine terms as a scaffold. Ultimately, the patient's own cells could be placed in this scaffold, creating a customized organ that the patient theoretically would not reject.

In fact, an analysis of the decellularized organs revealed that antigens likely to cause an immune response were removed in the cleaning process. "This finding has significant implications," said Orlando. "It indicates that transplantation of such customized kidneys could be performed without the need for anti-rejection therapy. In addition, these kidneys maintain their innate three-dimensional architecture, their basic biochemistry, as well as their vessel network system. When we tested their ability to be transplanted (in pigs), these kidneys were able to maintain blood pressure, suggesting a functional and resilient vasculature."

While the project is in its infancy, the idea represents a potential solution to the extreme shortage of donor kidneys. According to the authors, the probability in the U.S. of receiving a kidney transplant within five years of being added to the waiting list is less than 35 percent, and people age 60 or older who are placed on the waiting list only have a 50 percent chance of ever receiving a kidney.

The science of regenerative medicine has already had success in engineering skin, cartilage, bladders, urine tubes, trachea and blood vessels in the lab that were successfully implanted in patients. Most of these structures were able to receive oxygen and nutrients from nearby tissues until they developed their own blood vessel supply. However, more complex organs such as the kidney, liver, heart and pancreas are larger with dense cellular networks and must have their own oxygen supply to survive. The need for a blood supply is why scientists are exploring the possibility of using donor organs and "seeding" them with a patient's own cells.

As the research continues, the scientists will need to assess whether discarded organs with certain defects can be used to benefit patients. For example, some kidneys are rejected because of fibrosis (scarring) in the tiny vessels throughout the organ. Can these organs be recycled? Orlando said that time will tell but that early clinical data suggests that fibrotic lesions are reversible and that the human body has the ability to remodel kidney fibrosis and restore normal anatomy.

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